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# Rickettsial Diseases

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## **RMSF-Clinical Picture (*R. Rickettsia*)**

- Spring/Summer
- Incubation 2-14 days (Avg. 7)
- Fever, Myalgias, Headache
- Photophobia, Meningismus
- G.I. Symptoms
- Rash: Wrist/Ankles to Trunk  
after 3-5 days
- Black males G6PD Deficiency

# Rocky Mountain Spotted Fever Vectors

Western U.S.

Wood tick

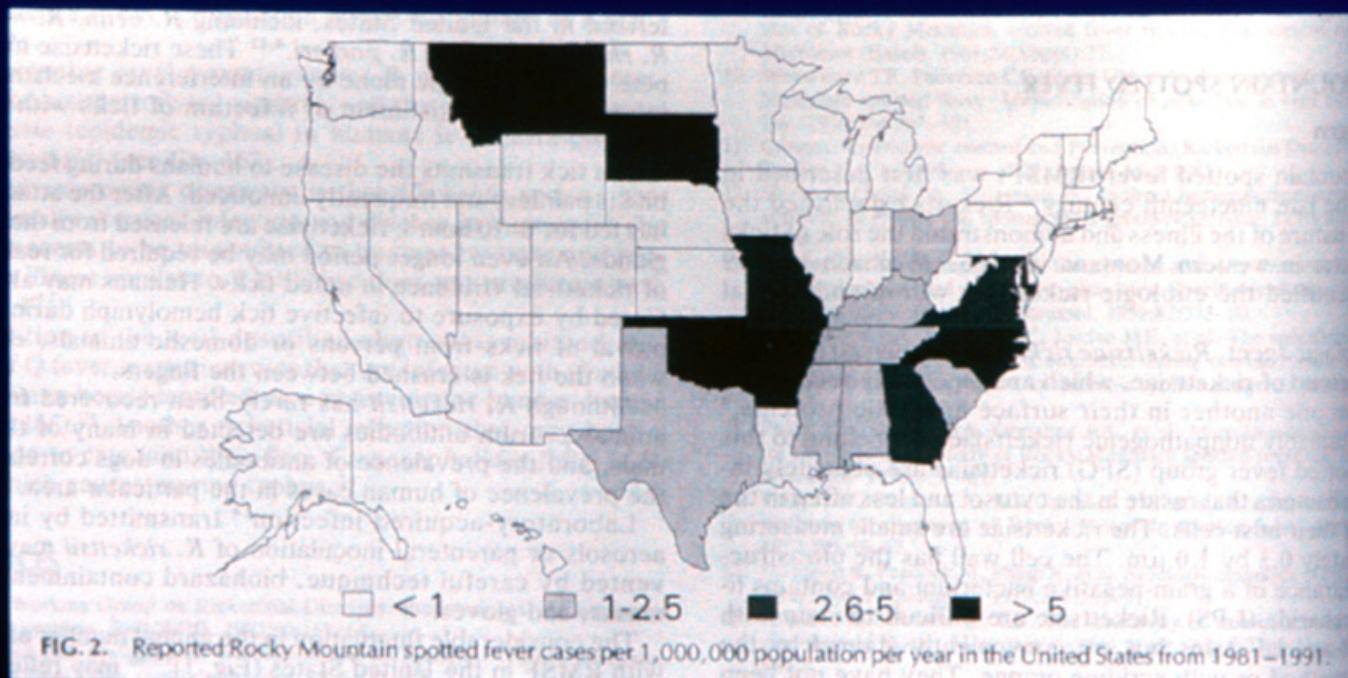
Eastern U.S.

Dog tick



Figure 39.2. Scanning electron micrographs of female American dog tick, *Dermacentor variabilis*. A, Dorsal view; B, ventral view.  $\times 7$ . (Courtesy of Dr. C. Clifford)

# RMSF Incidence



# RMSF -Diagnosis

- History and Physical
- Skin Biopsy DFA
- Serology
- Blood Clot Culture









# RMSF - Lab Abnormalities

- Anemia
- Thrombocytopenia
- Hyponatremia (ADH)
- Increased CK

## RMSF -Treatment

- Doxycycline 100 mg q 12 h.
- Tetracycline 25 - 50 mg/kg/d
- Chloramphenicol 50 -75 mg/kg/d
- (Quinolones, Rifampin)
- Erythromycin does not work!
- Duration 7 d., or 2 d. after fever remits



# **Epidemic Louse-Borne Typhus (*R. Prowazekii*)**

- **Body Louse**
- **Reservoir in Flying Squirrel**
- **Cold Weather**
- **Urban**

# Epidemic Typhus - Manifestations

- Rash: Axilla / Trunk to Arms
- Fever, Cough, Deafness, HA
- Photophobia, red eyes, delirium
- No Eschar
- Brill - Zinsser Disease
- RX 100 mg doxycycline (louse)

# Epidemic Typhus





# **Endemic (Murine and Cat Flea) Typhus**

***R. typhi* and *R. felis***

- Worldwide (Gulf Coast Texas/ Los Angeles)
- Rat & Rat Flea or Opossum & Cat Flea
- June to August (April to June in S. Texas)
- Mild to severe: Sporadic to epidemic

## **Endemic (Murine) Typhus**

- Fever, HA, chills, nausea, cough
- Neurologic SX 1-45%
- Rash 50% (trunk = extremities)
- Elevated AST, Decreased WBC & plts.



# Human Ehrlichiosis

- *E. chaffeensis* (HME)
- *Anaplasma phagocytophilia* (HGE)
- (*E. ewingii*) canine granulocytic ehrlichiosis
- (*Neorickettsia sennetsu*)

# Erlichiosis- Tick Vectors

- *Amblyomma americanum* (HME)
- *Ixodes scapularis* (HE—east US)
- *I. pacificus*— (west US)
- *I ricinus* – (Europe)

# Erlichiosis- Animal Reservoirs

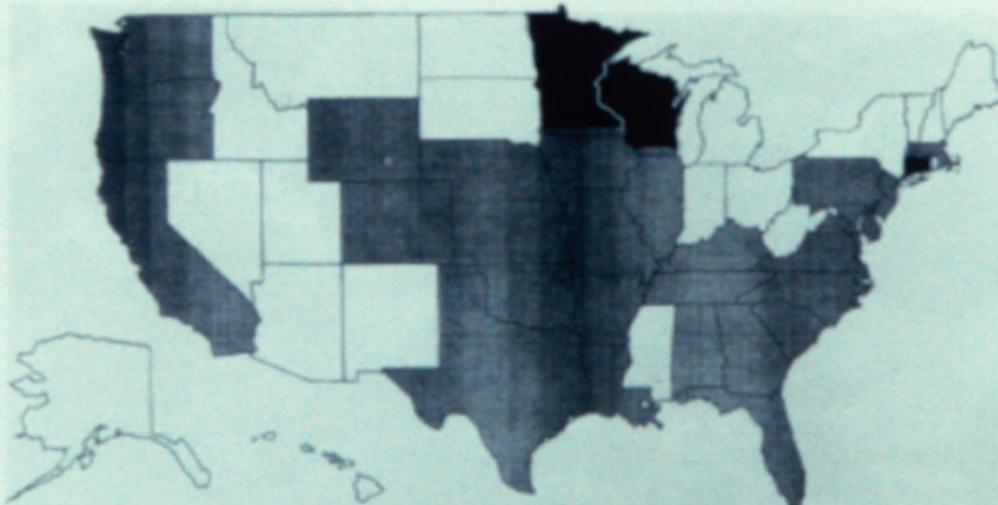
## HME

- White tail deer

## HGE

- Deer
- White-footed mouse

# Ehrlichiosis-Incidence

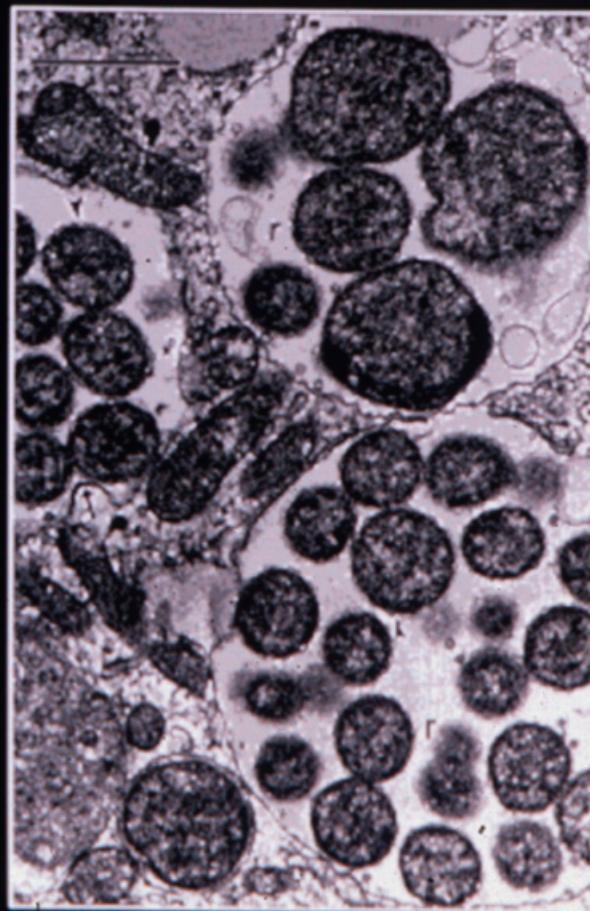


**Figure 2.** Geographic distribution of cases of human ehrlichiosis in the United States until 1994. □= states with monocytic ehrlichiosis; ■= states with granulocytic ehrlichiosis; ▨= states with no reports of ehrlichiosis. Data for monocytic ehrlichiosis are courtesy of Jacqueline Dawson, CDC.

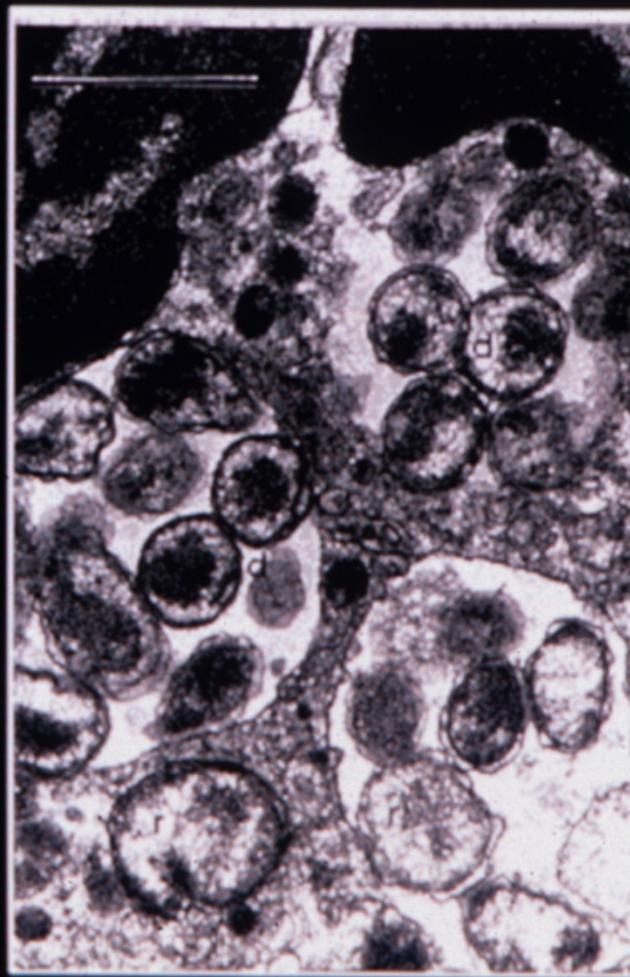
# Ehrlichiosis

- 93% cases April to Sept.
- No Rash
- Leukopenia, thrombocytopenia, elevated AST
- Chronic infection in animals

## Human Monocytic Ehrlichiosis



# Human Granulocytic Ehrlichiosis



# Erlichiosis- Diagnosis

- Serology
- Clinical diagnosis
- PCR
- Culture

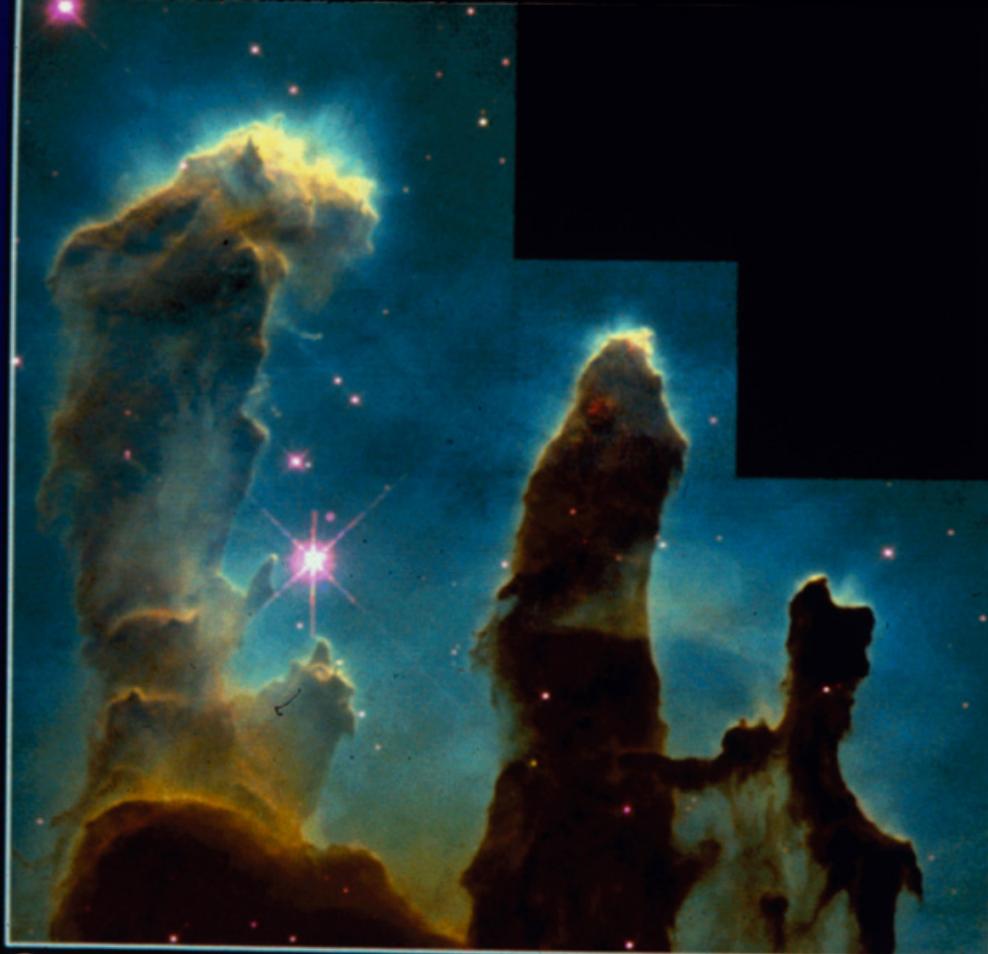
# Erlichiosis- Treatment

- Doxycycline-RX of choice
- Other considerations:
  - Chloramphenicol (ineffective in vitro)
  - Rifampin
  - Quinolone

# Erlichiosis-HIV Coinfection

- Fatality in 6/13 cases HME-HIV in one series

Paddock et al, Clin Infect Dis 33: 1586-94, 2001



Gaseous Pillars • M16

HST • WFPC2

PRC95-44a • ST Scl OPO • November 2, 1995

J. Hester and P. Scowen (AZ State Univ.), NASA

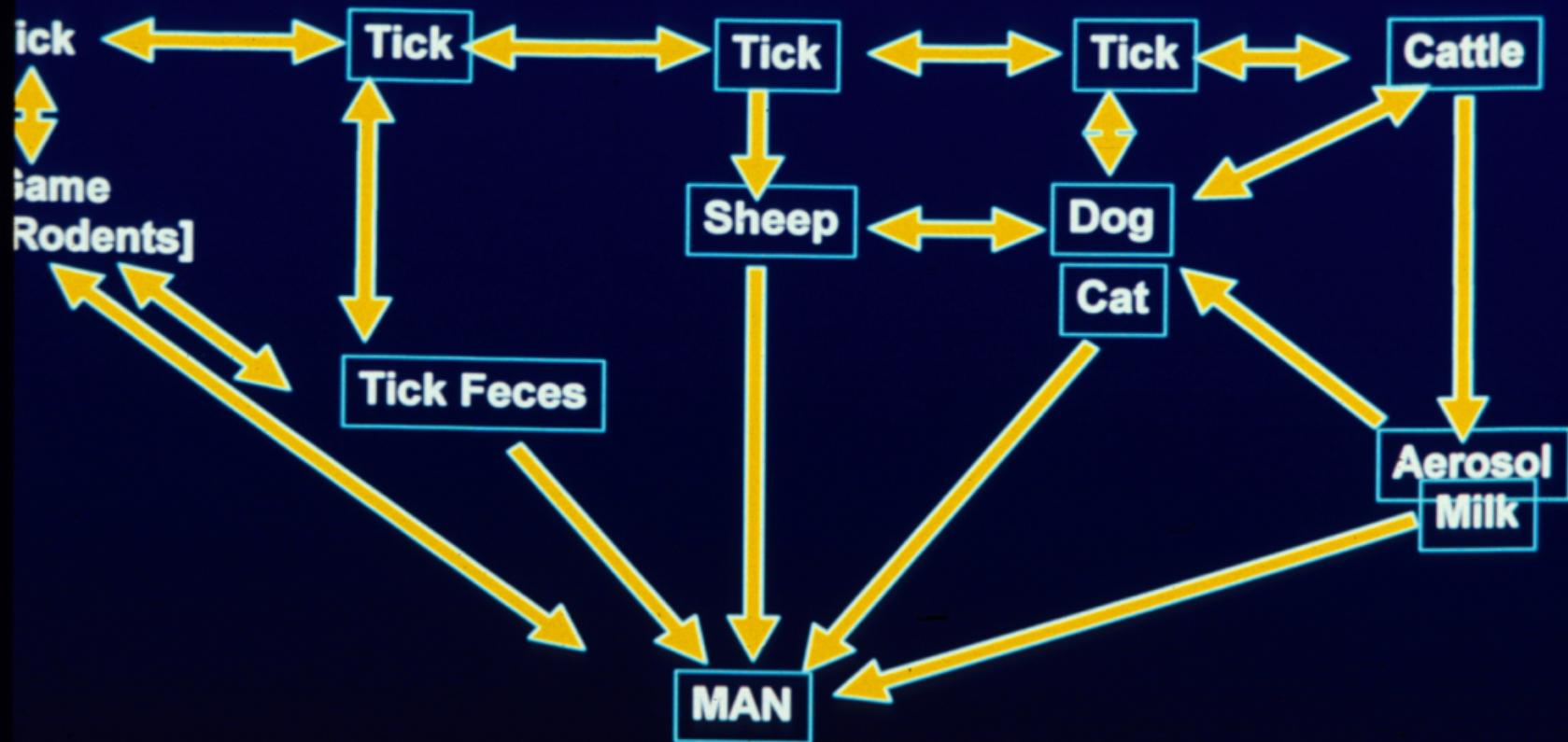
## **Q Fever (*Coxiella Burnetii*)**

- Incubation period: 14 - 39 days (mean = 20)
- Infectious dose: 1 organism
- Viability in environment:
  - wool: 10 months
  - cold meat: 1 month
  - skim milk: 40 months
- Infectivity after placenta exposure:
  - air: 14 days
  - soil: 150 days
- Infectious burden:
  - placenta  $10^9/g$
  - tick feces  $10^{10}/g$

# **Q Fever**

- **Reservoir in Cattle, Sheep, Goats**
- **Aerosolized Urine, Feces, Milk, Birth Products**
- **Incubation 14 to 39 d. (avg.20)**
- **Headache, Fever, Chills, Myalgia**
- **No Rash (usually)**
- **Occupational Disease**

# Q FEVER - INFECTIOUS CYCLE



From: Infection 15:323-327, 1987

# **Q Fever**

- **Infective route:** inhaled, oral, inoculated
- **Cat infection - recovery of *C. burnetii*:**
  - in urine at 2 months
  - in blood at 1 month
- **Cattle infection - recovered in milk**

# **Occupational Risk**

- Farmer \ Rancher
- Abattoir Worker
- Laboratory Worker
- Veterinarian
- Military

## Symptoms: Q Fever and Controls

P < .05

<u>Symptom</u>	<u>Q fever %</u>	<u>Controls %</u>
Fatigue	98	79.4
Chills	88.2	72.5
Sweats	84	68.6
Headache	72.5	52.9
Cough	28.4	79.4
Sore throat	13.7	33

Adapted from J.I.D. 158:101-108, 1988

## **Q Fever - Manifestations**

- Pneumonia (atypical, rapidly progressing, or w/o pulmonary SX)
- Endocarditis
- Hepatitis
- Osteomyelitis
- Meningitis / Encephalitis

МИАС

## **Activities of Patients Q Fever and controls P < .05**

<u>Activity</u>	<u>Q fever %</u>	<u>Controls %</u>
<b>Contact with:</b>		
Cats	<b>58.8</b>	<b>38.8</b>
Cattle	<b>29.4</b>	<b>11.6</b>
Sheep	<b>11.7</b>	<b>1.9</b>
Ticks/animal	<b>9.8</b>	<b>1.9</b>
<b>Working on a farm</b>	<b>15.6</b>	<b>4.8</b>
<b>Slaughter/dress animal</b>	<b>11.7</b>	<b>2.9</b>

Adapted from J.I.D. 158:101-108, 1988

## **Q fever-Hepatitis**

- Acute infectious Hepatitis
- FUO- granulomatous hepatitis
- Incidental finding with pneumonia

## **Q Fever**

### **Phase changes**

#### **Phase I:**

**Infective stage with extensive carbohydrate covering surface proteins.**

**Can also be developed by passage through lab animals.**

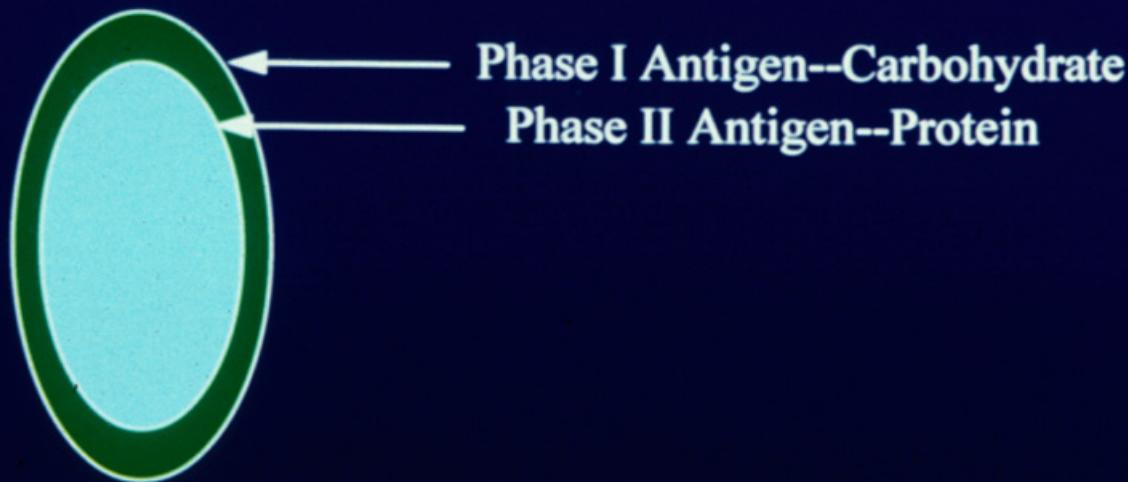
#### **Phase II:**

**Nonvirulent stage developed by serial passage in embryonated eggs.**

**This stage lacks the extensive carbohydrate layer around its surface proteins.**

# *Coxiella burnetii*

## Antigens for Serodiagnosis



## **Q Fever Plasmids**

- Plasmid DNA present in all *C. burnetii*
- Plasmids predispose type of infection
- Plasmids do not change during phase conversion
- Phase I LPS influenced by plasmid profile

## **Q Fever: Serodiagnosis**

- Phase II>Phase I: Acute disease
- IgM IFA positive: Acute disease
- Phase I>Phase II: Chronic disease
- Phase I IgA titer positive: Endocarditis

## **Q Fever - Histopathology**

- Lung: alveolar exudate with histiocytes but no PMN's
- Liver and bone marrow: clear space surrounded by inflammatory cells and fibrin ring (doughnut lesion)

## **Q Fever - Immunity**

- Endocarditis - lack of *in vitro* proliferation to *C. burnetii* antigens
- Immunity related to skin test reactivity, not antibody titer
- Skin test can cause seroconversion
- Phase I antigen 100 - 300 x more protective than phase II antigen

## **Q Fever - Complications**

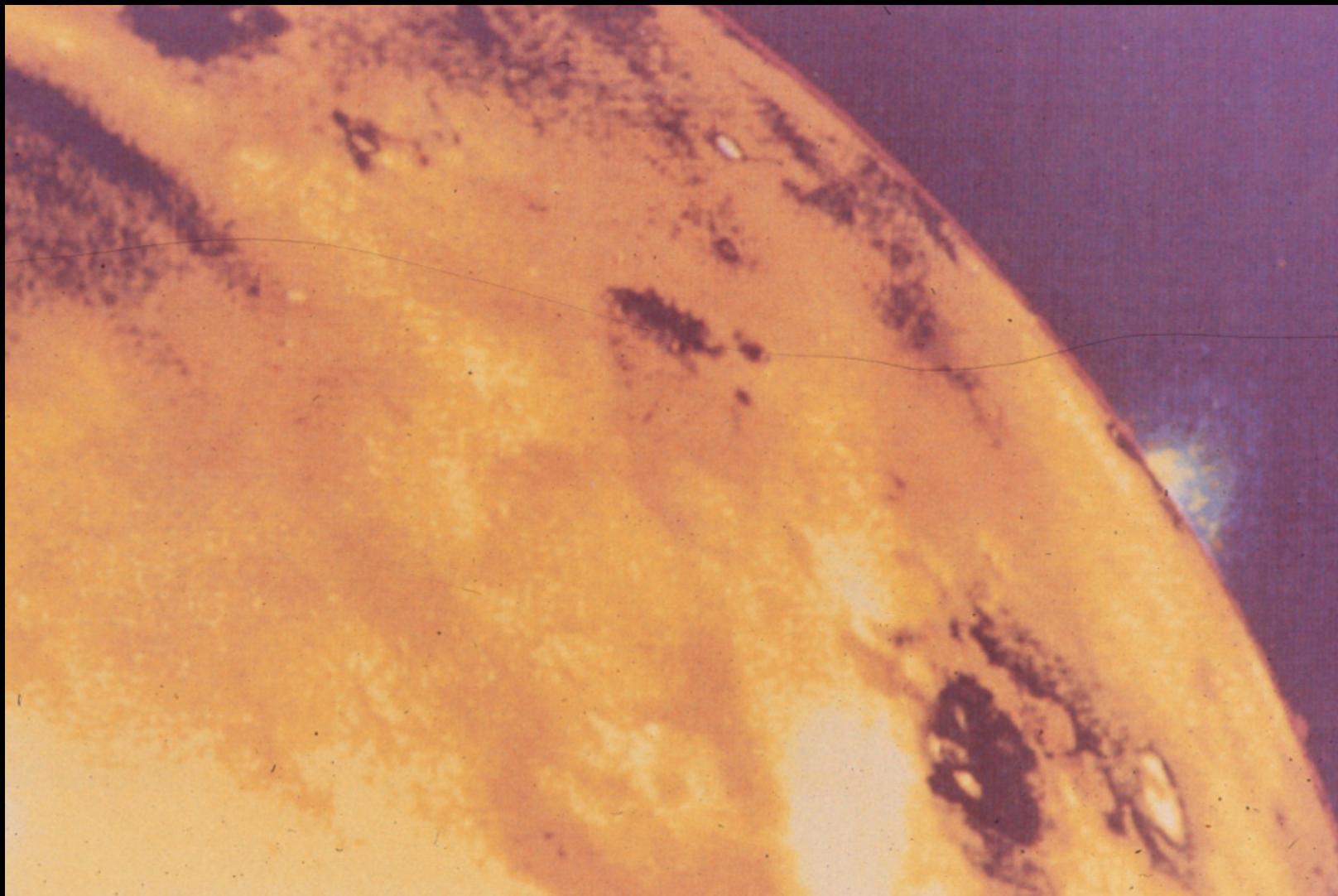
- Marrow necrosis, aplastic anemia, hemolysis
- Optic neuritis
- Myocarditis, pericarditis
- Pancreatitis, mesenteric panniculitis
- Lymphadenopathy
- SIADH, DVT, erythema nodosum
- Epididymitis, orchitis, priapism

## **Q Fever: Therapy**

- Pneumonia- duration of fever
  - 3.3 days no RX
  - 2.0 days tetracycline
  - 1.7 days doxycycline
- Hepatitis- 2 weeks RX
- Endocarditis- combination RX for > 1 year

## **Q Fever - Prevention**

- Separate area for animal parturition
- Carefully dispose of animal placentas / stillborn kittens
- Abattoirs - remove animal mammarys and viscera - keep skin wet until salted
- Pasteurize milk
- Keep immunocompromised patients and pregnant women away from infectious sources

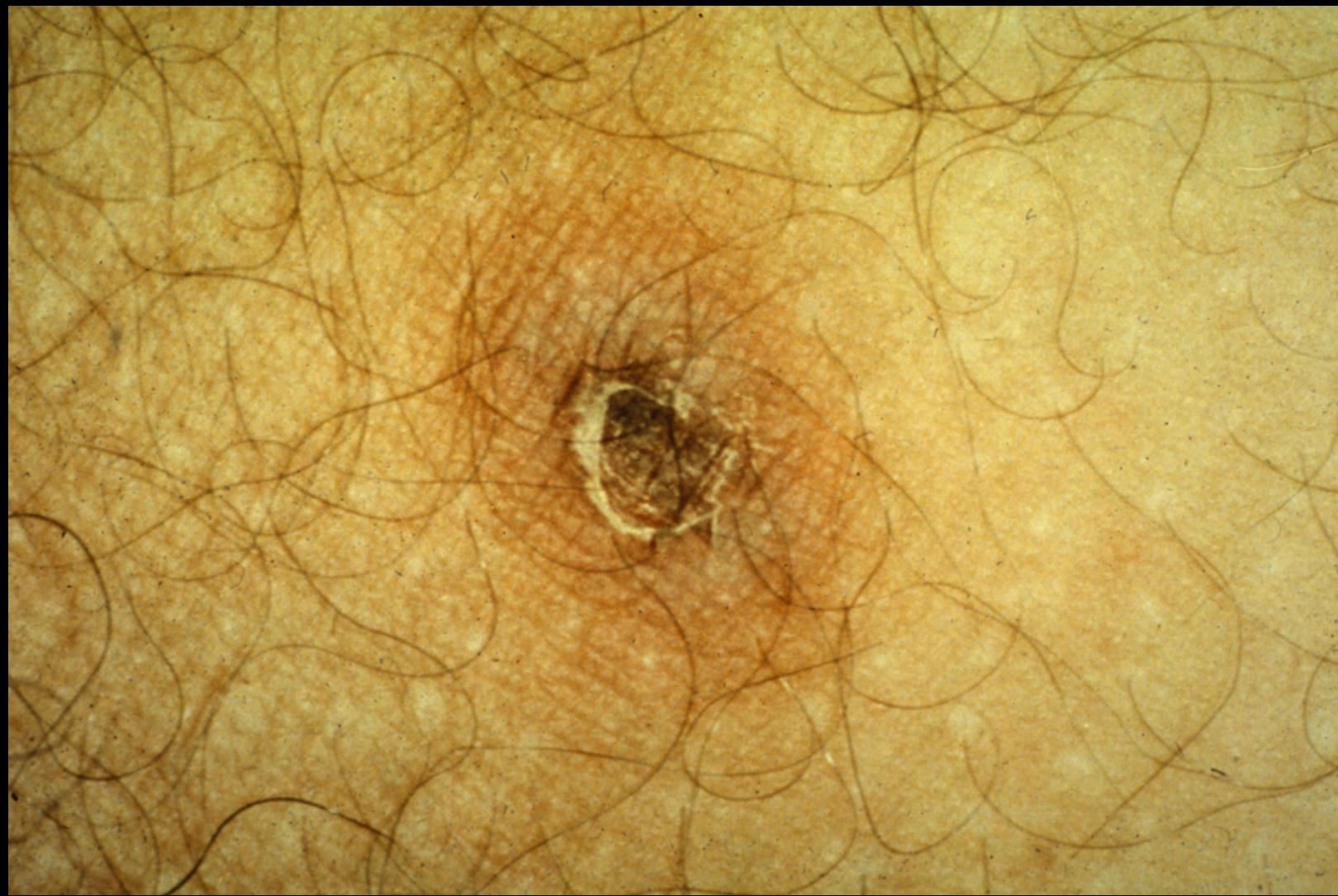


# **Tick Typhus of the Eastern Hemisphere**

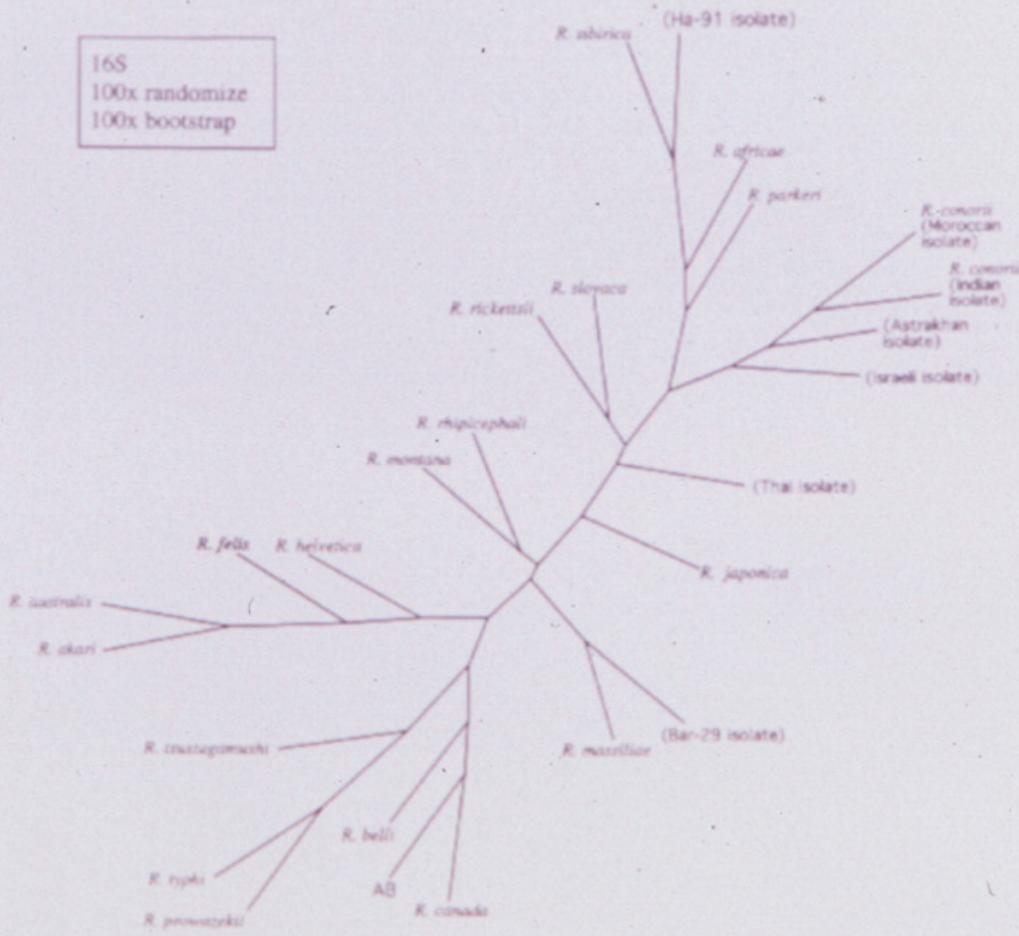
- **Boutonneuse fever, Queensland tick typhus, North Asian tick typhus**
- **Hosts: ticks, rodents, (dogs, marsupials)**
- **Nymphal *Rhipicephalus* “invisible”**
- **Rash: trunk, extremities, face**
- **Eschar present**

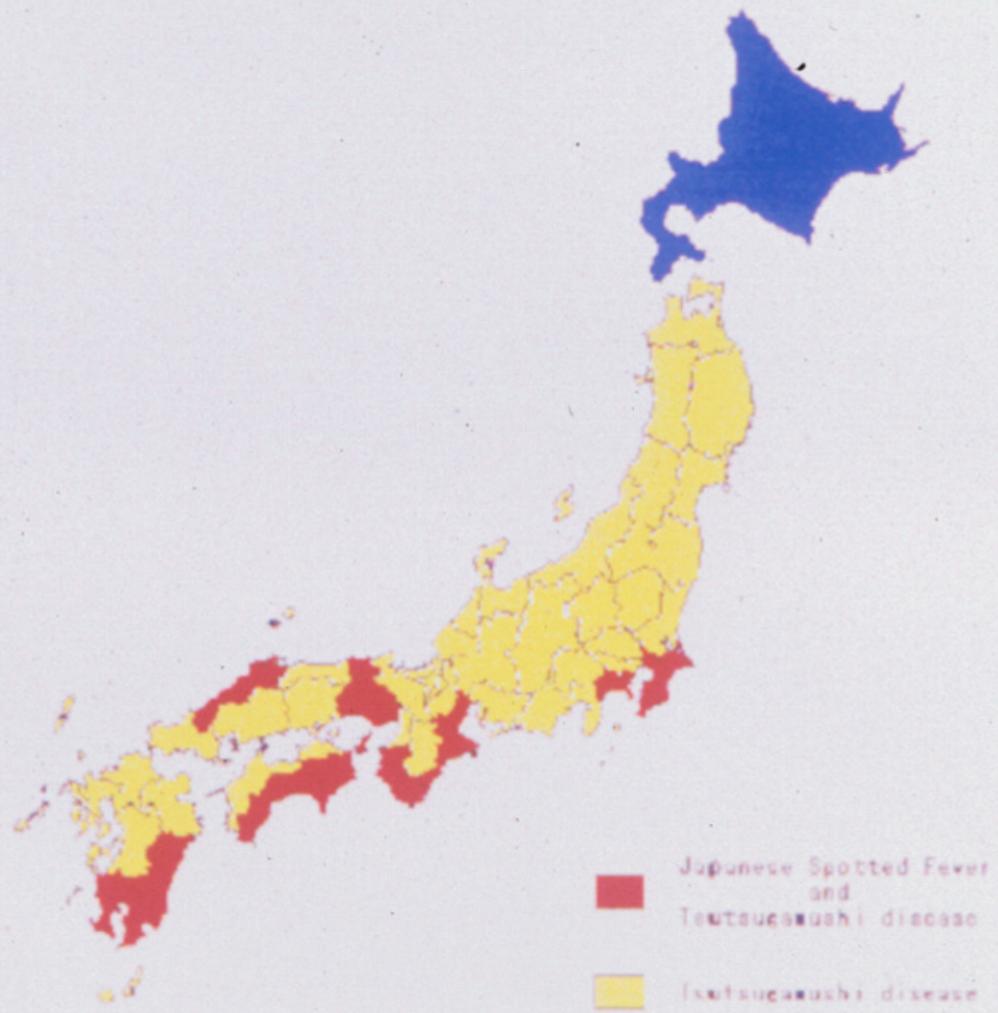
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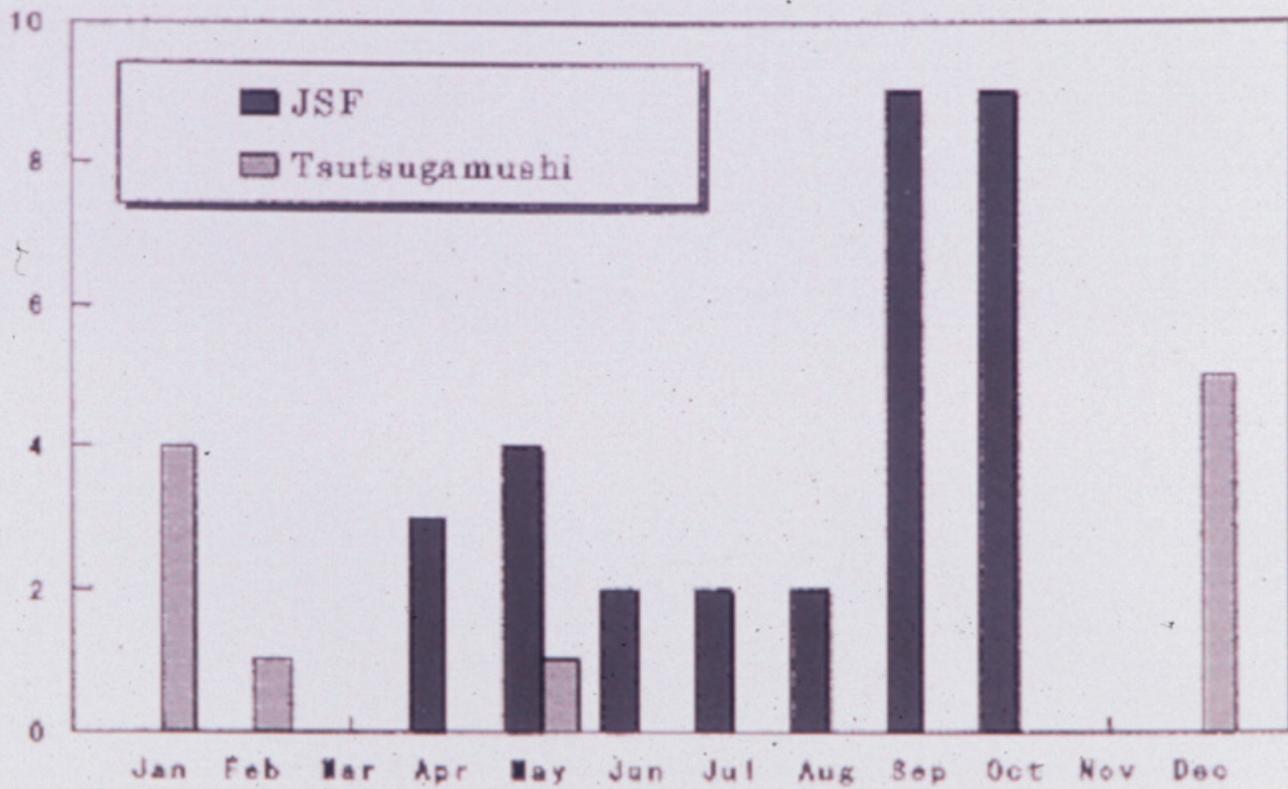
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16S  
100x randomize  
100x bootstrap







# **Scrub Typhus**

- Chiggers (Trombiculid Mites)
- Far East
- Eschar and Adenopathy
- Fever, Headache, Myalgia



# Rickettsial Pox

- Mouse mite / mouse zoonosis
- Painless Ulcerating Papule
- Chills, Fever, Headache
- Papulovesicular Rash  
resembling varicella
- Worldwide distribution

